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(54) IMPROVEMENTS IN OR RELATING TO MOUNTING SYSTEMS

(71) I, THE SECRETARY OF STATE FOR DEFENCE, London, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to mounting systems for heavy equipment, and particularly to those items of heavy equipment for which it is desirable that one part of the mounting permits movement of the equipment through a large arc about one axis and through a small arc about an axis perpendicular thereto. Such items of equipment include, for example, telescopes and guns and, particularly, to guns mounted on vehicles for which the primary aiming in azimuth is achieved by directing the vehicle. In such equipment it is necessary to make provision in the mounting for full movement in elevation and it is desirable to provide a facility for fine adjustment in azimuth to supplement the primary aiming.

Conventional gimbal-type bearings for such equipment can be undesirably heavy, particularly if the system is required to be readily transportable, and in the case of guns mounted on vehicles can make frontal armour design difficult. This invention therefore provides a light and compact means of applying a limited rotational movement in such arrangements.

This invention consists of mounting system for heavy equipment, the system comprising two coaxial trunnion pins each having an eccentric bearing portion on which the equipment is mounted, whereby rotation of the equipment about an axis perpendicular to the axis of the trunnion pins can be achieved by axial rotation of the trunnion pins in relatively opposite senses.

Conveniently the said eccentric bearing portions incorporate self-aligning bearings.

In a preferred arrangement, the trunnion pins as aforesaid are supported at each end in bearings on a mounting, means being

provided to rotate the trunnion pins axially at equal speeds in opposing senses.

By way of example, a gun mounting in accordance with the invention will now be described with reference to the part-sectional schematic view filed with the provisional specification:

A gun 1 is supported within a fork mounting whose forked arms 2 and 3 are rigidly fixed to a vehicle. The end of each arm remote from the vehicle is provided with two extensions each having an orifice, in bearings in which a trunnion pin 4 is rotatably mounted, the four orifices and hence the two trunnion pins being coaxial. The gun 1 is supported on the trunnion pins via a mounting member 5 fixed to the gun and having side arms 6 and 7 each provided at its end with a bearing 11 rotatably mounted on the intermediate portion 8 of a trunnion pin 4 between the extensions of the corresponding fork.

Since the axis of the trunnion pins is normally essentially horizontal, aiming of the gun in elevation is achieved by rotation of the gun about the intermediate portions 8 of the trunnion pins.

For ease of assembly, the trunnion pins are in three integral portions, the diameter of the portion within the orifice adjacent to the gun being less than that of the portion within the orifice remote from the gun. The intermediate portion 8 of each trunnion pin, however, is of intermediate diameter and offset axially with respect to the adjoining portions, so that the gun 1 and mounting member 5 rotate about eccentric axes. A drive 10 is provided to rotate the trunnion pins simultaneously, at the same speed and in opposing senses, it being arranged that the intermediate portions 8 of the trunnion pins are at the top, or alternatively at the bottom, of their movement simultaneously.

The vertical plane in which the axis of the gun lies is defined by the centre points of the intermediate portions 8 of the trunnion pins, the plane being transverse to the

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line connecting them. On rotation of the trunnion pins from the position in which the said intermediate portions are at the bottom of their travel, the line of centres 9, initially parallel to, and in the vertical plane through, the axis of the trunnion pins, remains horizontal but turns through a small angle about a vertical axis. The line of centres 9 rises and falls during the movement, but the resulting raising and lowering of the gun causes no significant detrimental effect on the percision of aim of the gun.

The amount of rotation, and hence the extent of adjustment of azimuth of the gun possible by actuation of the drive 10, depends on the relative dimensions of the fork and the eccentricity of the intermediate portions 8 but a figure of about  $\pm 2^\circ$  from the mean position is in practice found to be reasonable.

It is clear that some form of self-aligning device must be incorporated into the bearings 11, since the intermediate portions 8 of the trunnion pins do not remain coaxial during rotation. This device can be of any conventional type. Other ways of providing an eccentric mounting, within the scope of this invention, to provide an azimuthal adjustment will be readily apparent to those skilled in the art: an off-axis portion can be incorporated into many different conventional forms of mounting to achieve this effect. A fork mounting as illustrated has the obvious advantages of compactness and rigidity, but other forms, or other arrangements of bearings at the ends of the forks, may be desirable in different applications.

#### WHAT I CLAIM IS:—

(1) A mounting system for heavy equipment, the system comprising two coaxial trunnion pins each having an eccentric bearing portion on which the equipment is mounted, whereby rotation of the equipment about an axis perpendicular to the axis of the trunnion pins can be achieved

by axial rotation of the trunnion pins in relatively opposite senses.

(2) A mounting according to Claim 1 in which the said bearing portions incorporate self-aligning bearings.

3. A mounting system according to either preceding claim in which the trunnion pins are supported at each end in bearings on a mounting, means being provided to rotate the trunnion pins axially at equal speeds in opposite senses.

(4) A mounting system according to Claim 3 in which the mounting is of the fork type, each arm of which is provided with two extensions each having an orifice, the two trunnion pins being mounted, one at the end of each arm, in bearings in the orifices, all four orifices being coaxial.

5. A mounting system according to Claim 4 in which each trunnion pin comprises three portions, an inner portion mounted in a fork extension adjacent the equipment, a coaxial outer portion, having a greater diameter than the inner portion and being mounted in a fork extension remote from the equipment, and a central, bearing portion of intermediate diameter and offset axially with respect to the inner and outer portions, the equipment being rotatably mounted on the said central portion.

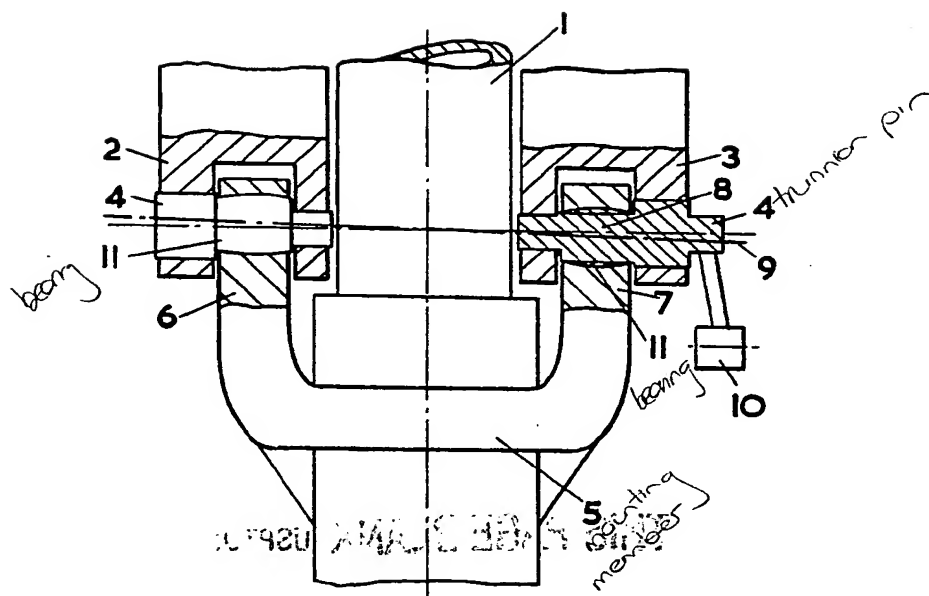
6. A mounting system according to any preceding claim, incorporated on a vehicle with the axis of the trunnion pins located in a substantially horizontal plane, whereby small adjustments of the aiming of the equipment can be achieved by the said rotation of the trunnion pins in relatively opposite senses.

6. A gun mounting constructed and arranged to operate substantially as hereinbefore described, with reference to the drawing filed with the provisional specification.

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